

Effect of nutrients inputs on growth , chlorophyll and tissue nutrients concentration of Ulva sp.

ชื่อโครงการ	Effect of nutrients inputs on growth , chlorophyll and tissue nutrients concentration of Ulva sp.
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Introduction

Excess nutrient loads human activities lead to algal bloom, the world wide problem, by increasing production of algae. When those algae occur in dense blooms, they can cause fish and invertebrate killed because dissolved oxygen is consumed when the bloom decomposes and it also degrade the recreation amenity of the beaches.

The growth of macroalgae is controlled, in large part, by nutrients as well as salinity, light and temperature. N and P are the two most common nutrients that limit macroalgal growth.(Kamer and Schiff.,2002)For the majority of algal species, ammonium is the most easily assimilated type of Dissolved Inorganic Nitrogen(DIN), although some species may prefer nitrate, nitrite or and organic form such as urea. (Jones.,1993) Opportunistic macroalgae can uptake, assimilate and store a large amount of nutrients, resulting in low nutrients concentration in the water column, even in the area of high loading (Valiela et al.,1992;Peckol et al., 1994) thus, they are allowed to grow at maximal rates for several days without nutrients supplies.

Ulva spp.,also known as sea lettuce, are a common fast-growing macroalgae of the littoral zone and are generally known as one of the species forming “green tides”. Ulva spp. Are usually the first colonizers on open substrata, and their cosmopolitan presence is attribute to their tolerance of a wide range of environment. (Littler and Littler, 1980) Moreover, Ulva sp. Are particular good bioindicators of eutrophication, even better than simply testing water itself. Their levels of nutrients in the tissue results from the long-term integration and accumulation from the surrounding water while water-column analysis would only detect the instantaneous nutrients concentration in the time of sampling However it has recently been shown the analyses of pigment content of macroalgae can provide an accurate representation of the nutrient status in the water body .(Jones 1994)

Objectives

1. To determine if N or P is the most limiting nutrient to *Ulva* sp.
2. To study the effects of nutrients inputs on growth, tissue nutrients and chlorophyll concentration of *Ulva* sp.
3. To investigate uptake rates of *Ulva* sp. When distinct form of nutrients are added

Materials and Methods

Experimental design

Approximately 10 g (wet weight) of *Ulva* sp. Will be placed in jars filled with sterile seawater and left for 3 days to deplete algae of nutrients store before starting the experiment. The background levels of nutrients were investigated. Water was circulated by bubbling with compressed air under controlled light and temperature.

The experiment composed of six treatments ; 33 flasks received NO_3^- alone , 33 receive NH_4^+ alone , 33 received additions of PO_4^{3-} alone , 33 received NO_3^- in combination with PO_4^{3-} , 33 received NH_4^+ in combination with PO_4^{3-} and 33 were maintained at the initial nutrients status (Ci low). 6 more jars contained nutrients but not algae were used as controls. Water samplings were at 0,1,2,4,8,12,24,48,72 h. of the experiment. Once water samples were collected, each flask was discarded. Uptake rates of inorganic nitrogen and phosphorus were determined by measuring the disappearance of inorganic nutrients from time over time. (Herlin and Wheeler , 1985)

$$\mu\text{mol N g}^{-1} = \frac{(C_i - C_f) * \text{volume}(l)}{\text{length of incubation}(h)} \times \frac{1}{\text{gDW plant}}$$

Where C_i is the initial concentration of nutrients () and is the final concentration () at each time interval (0 - 4 day and 4 - 7 days).

Macroalgae were extracted twice during the experiment, on day 4 and 7. After 4 days. dry weight, tissue C N and P and total chlorophyll a concentration of the algae from three flasks from each treatments were analysed.

Statistical analysis

One-way ANOVA with a level of significance of 5% is used to study the effect of the enrichment of distinct form of nutrients on growth rate, nutrients uptake and on tissue nutrients and chlorophyll concentration of *Ulva* sp. After 4 and 8 days.

Two-way ANOVA is used to test differences among N uptake rates as nitrate or ammonium alone or in combination with P.

Results

Nutrients uptake rates

The uptake rate of *Ulva* sp. In all nutrients added treatments was significantly higher than in Ci low treatment (maintained at the initial status). The phosphate uptake rate is higher when it was added alone than in combination with N. ($p < 0.001$)

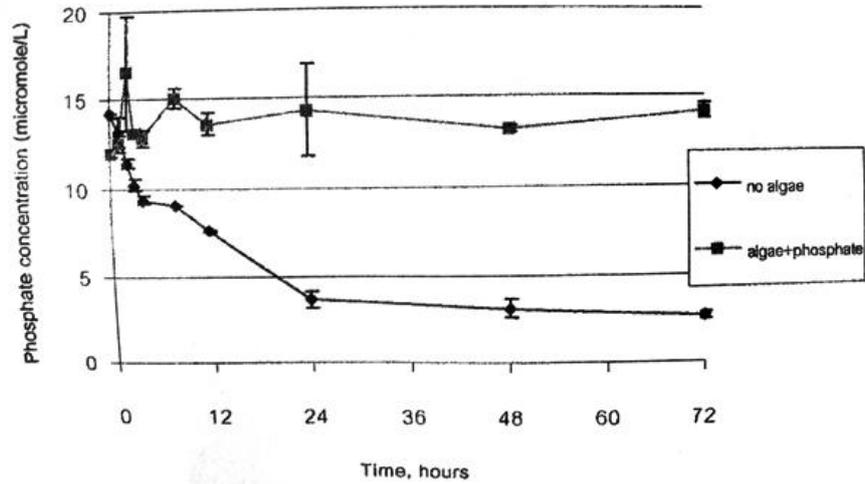
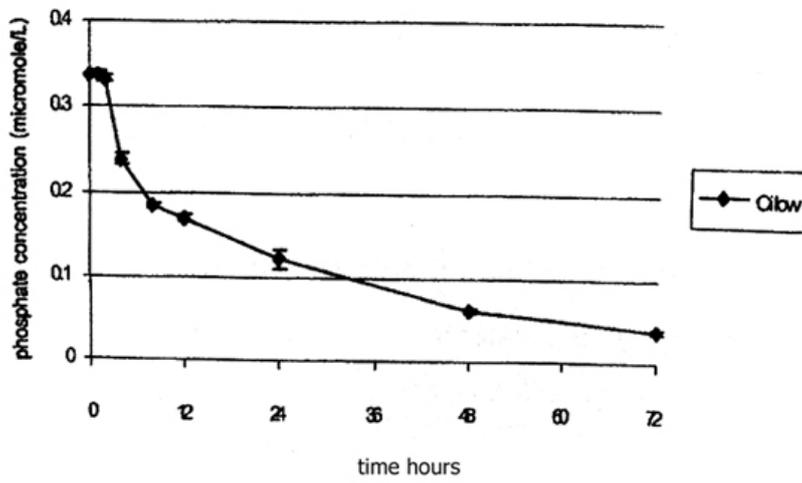
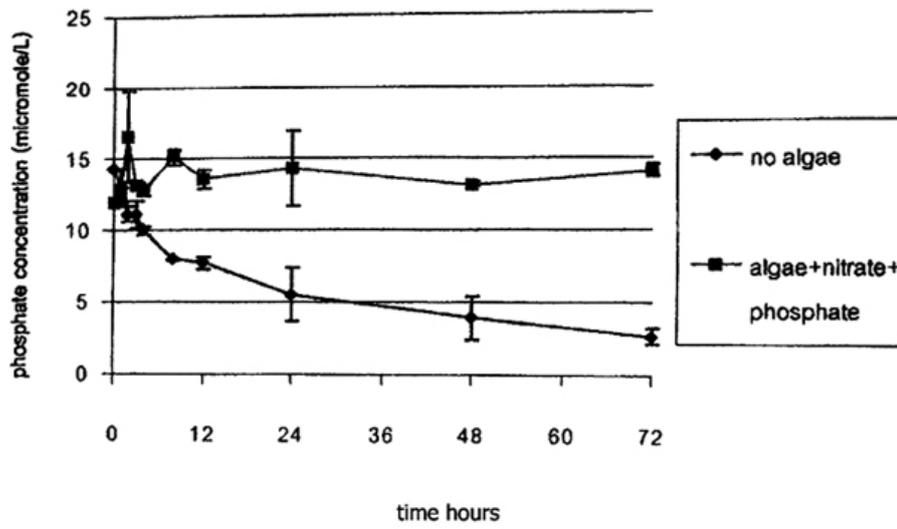
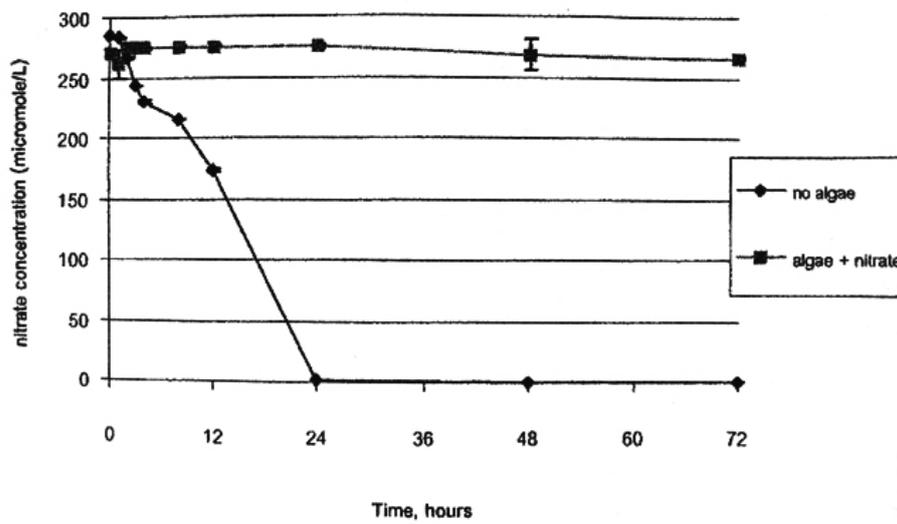


Fig. 1 - Phosphate uptake of *Ulva* sp. During 72 hours after nutrients were added : phosphate , phosphate in combination with nitrate and Ci low.



The uptake rate of nitrate is significantly higher when it was added alone than in combination with phosphate ($P < 0.001$)



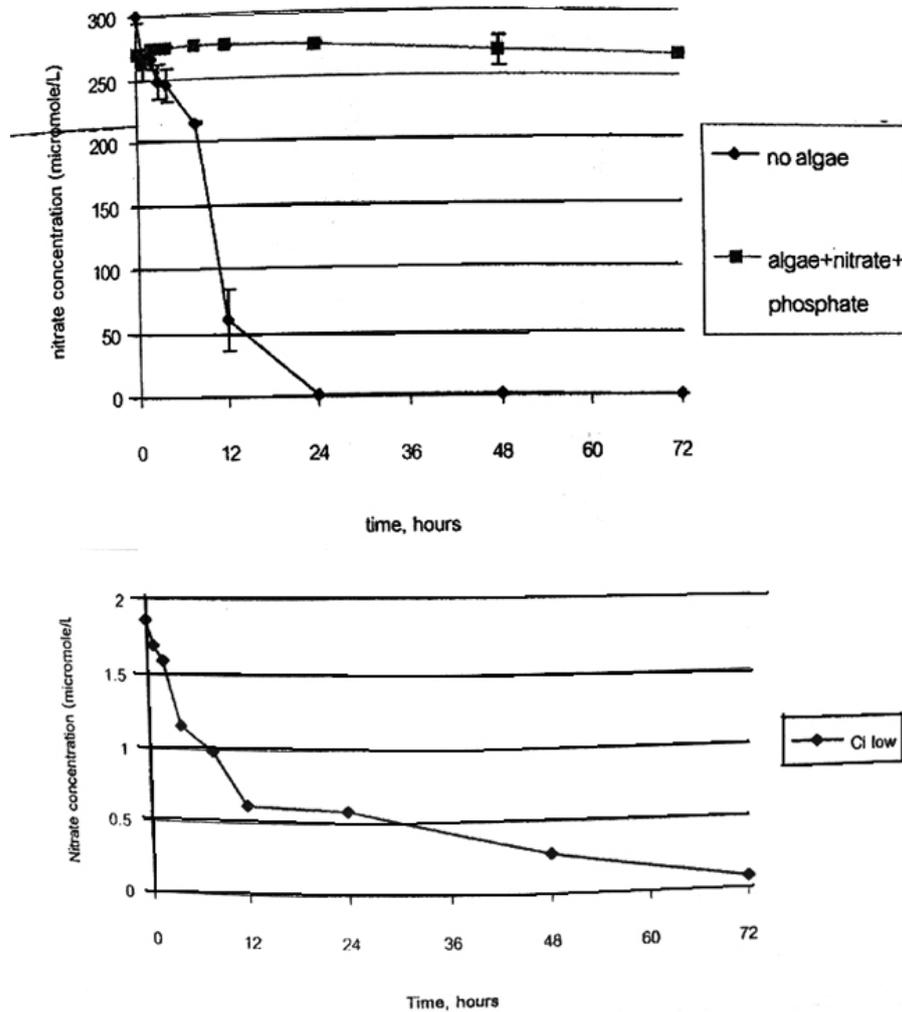


Fig 2 - Nitrate uptake of *Ulva* sp. During 72 hours after nutrients were added. : nitrate , nitrate in combination with phosphate and Ci low.

Discussion

The final concentration of nutrients added in each treatments is more than 10 times higher than the concentration observed in summer. *Ulva* sp. Can deplete nitrate in the water body in 24 hour in the nutrient added treatments and the net uptake rate is significantly higher than in Ci low treatment ($p < 0.001$) and in phosphate treatment, the phosphate uptake rate is also higher then in Ci low treatment ($p < 0.001$).Bothe indicate the luxury uptake of nutrients and the ability to store large amount of nutrients.

Conclusions

Our results show the capability of luxury uptake for nitrogen and phosphorus in *Ulva* sp. Which give them a selective advantage to allow well in several days without nutrients supplies and make it the dominant macroalga causing bloom in the area which experiences high nutrient loads.

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